Uncertainty Quantification for Production Navier-Stokes Solvers, Phase II

Completed Technology Project (2011 - 2013)

Project Introduction

The uncertainty quantification methods developed under this program are designed for use with current state-of-the-art flow solvers developed by and in use at NASA. The Phase I program demonstrated the CRISP CFD

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error quantification and reduction code with simulations conducted using the NASA unstructured solvers FUN3D and USM3D. Phase I provided evidence supporting the suspected need for an error prediction code that matches the finite volume scheme of the Navier-Stokes solver itself. Phase II will continue this work by expanding our Error Transport Equation (ETE) solver to treat both classes of unstructured grid finite volume schemes. Support for the CGNS standard will be implemented and permit use of the Phase II product by a broader spectrum of potential users. Specific issues that affect numerical accuracy of the error predictions and how they propagate into integrated quantities such as lift and drag coefficients will be addressed. Reduction of error for large scale meshes is a matter of equal importance, and improvements are planned that will provide for anisotropic grid refinement within the existing CRISP CFD

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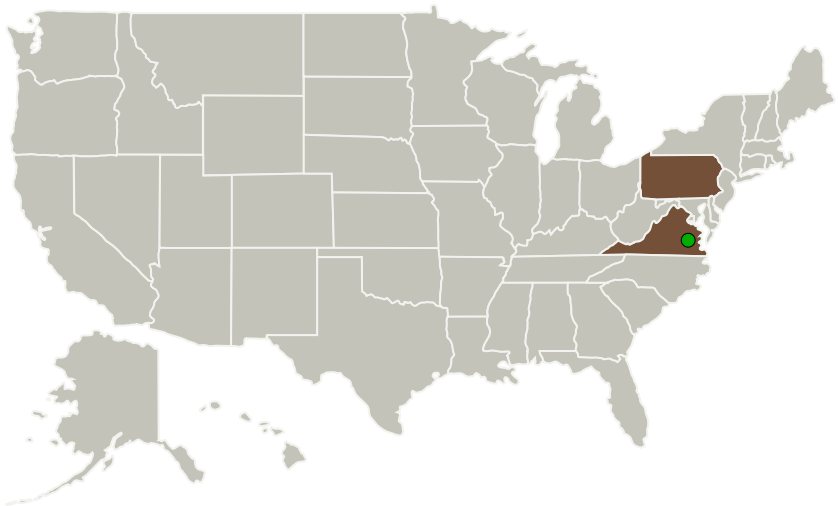
mesh adaptation code. Finally, error quantification approaches for transient applications will be explored to expand these developments to problems that involve inherent unsteadiness and/or moving boundaries.

Primary U.S. Work Locations and Key Partners



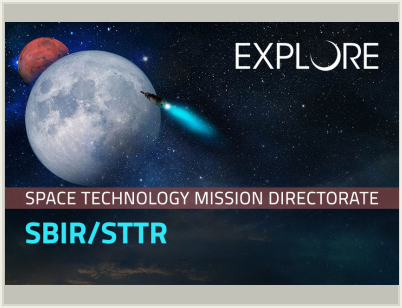


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Table of Contents

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Organizations Performing Work	Role	Type	Location
CRAFT Tech - Combustion Research and Flow Technology	Lead Organization	Industry	Pipersville, Pennsylvania
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Pennsylvania	Virginia

Project Transitions

June 2011: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139407)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CRAFT Tech - Combustion Research and Flow Technology

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

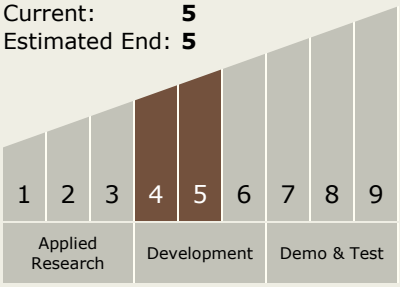
Carlos Torrez

Principal Investigator:

Peter Cavallo

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.3 Simulation
    - TX11.3.6 Uncertainty Quantification and Nondeterministic Simulation Methods

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System